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## 2. INFANT SURVIVAL AND MORTALITY IN FREE-RANGING HANUMAN LANGURS, *PRESBYTIS ENTELLUS* JODHPUR, WESTERN INDIA

Studies of non-human primate life histories are vital because life histories are key elements of population dynamics. Detailed studies of life tables and demographic parameters for free-ranging non-human primates are still comparatively rare (Winkler *et al.* 1984). In this paper, I present life tables for infants born in three troops of Hanuman langurs (*Presbytis entellus*) between December 1982 and September 1985. These troops named B, KI and KII lived in a semi-arid habitat about 8 km west of Jodhpur in Rajasthan State, Western India. Long-term troop history details are also available for these troops (Agoramoorthy *et al.* 1988). The study troops were monitored between December 1982 and September 1985 to record demographic and social

behaviour data (Agoramoorthy and Mohnot 1988). Ad-libitum sampling was used as observational method (Altmann 1974). In total 41 new born infants were observed during my study with a total sex ratio of 0.46 female per male. One still birth in troop B has been excluded from the sample. Life tables for the period from birth to twelve months of life were worked out. Calculations were based on Caughley (1977) by using the mortality rate ( $qx$ ), that is proportion of animals alive at age  $x$  that die before the age  $x + 1$ . The  $px$ ,  $lx$ ,  $dx$  were converted from  $qx$ . This method was preferred instead of calculating  $lx$  directly from the animals still alive at a given age out of total  $f$ . The sample  $fx$  gives the total number of male and female infants still surviving at the

TABLE 1  
SURVIVORSHIP OF MALE AND FEMALE INFANTS BORN IN TROOP B OF  
HANUMAN LANGUR (*Presbytis entellus*) OF JODHPUR

Age months	Sample $fx$		Mortality rate $qx$		Survival rate $px$		Survival $lx$		Mortality $dx$	
	M	F	M	F	M	F	M	F	M	F
0	10	2	0.100	0	0.900	1.000	1.000	1.000	0.100	0
1	9	2	0.111	0	0.889	1.000	0.900	1.000	0.100	0
2	8	2	0	0.500	1.000	0.500	0.800	1.000	0	0.500
3	8	1	0.125	0	0.875	1.000	0.800	0.500	0.100	0
4	7	1	0	0	1.000	1.000	0.700	0.500	0	0
5	7	1	0	0	1.000	1.000	1.000	0.700	0	0.00
6	7	1	0	0	1.000	1.000	0.700	0.500	0	0
7	7	1	0	0	1.000	1.000	0.700	0.500	0	0
8	7	1	0	0	1.000	1.000	0.700	0.500	0	0
9	7	1	0	0	1.000	1.000	0.700	0.500	0	0
10	7	1	0	0	1.000	1.000	0.700	0.500	0	0
11	7	1	0	0	1.000	1.000	0.700	0.500	0	0
12	7	1	0	0	1.000	1.000	0.700	0.500	0	0

M = Male; F = Female.

TABLE 2  
SURVIVORSHIP OF MALE AND FEMALE INFANTS BORN IN TROOP KI OF  
HANUMAN LANGUR (*Presbytis entellus*) OF JODHPUR

Age months	Sample $fx$		Mortality rate $qx$		Survival rate $px$		Survival $lx$		Mortality $dx$	
	M	F	M	F	M	F	M	F	M	F
0	5	7	0.200	0.142	0.800	0.858	1.000	1.000	0.200	0.
1	4	6	0	0	1.000	1.000	0.800	0.858	0	0
2	4	6	0	0	1.000	1.000	0.800	0.858	0	0
3	4	6	0	0.166	1.000	0.834	0.800	0.858	0	0
4	4	5	0	0	1.000	1.000	0.800	0.716	0	0
5	4	5	0	0	1.000	1.000	0.800	0.716	0	0
6	4	5	0	0	1.000	1.000	0.800	0.716	0	0
7	4	5	0.250	0	0.750	1.000	0.800	0.716	0.200	C
8	3	5	0	0.200	1.000	0.800	0.600	0.716	0	C
9	3	4	0	0	1.000	1.000	0.600	0.573	0	C
10	3	4	0	0	1.000	1.000	0.600	0.573	0	C
11	3	4	0	0	1.000	1.000	0.600	0.573	0	C
12	3	4	0	0	1.000	1.000	0.600	0.573	0	C

M = Male; F = Female

TABLE 3  
SURVIVORSHIP OF MALE AND FEMALE INFANTS BORN IN TROOP KII  
OF HANUMAN LANGUR (*Presbytis entellus*) OF JODHPUR

Age months	Sample $fx$		Mortality rate $qx$		Survival rate $px$		Survival rate $px$		Mortality $dx$	
	M	F	M	F	M	F	M	F	M	F
0	13	4	0.154	0	0.846	1.000	1.000	1.000	0.154	0
1	11	4	0	0.250	1.000	0.750	0.846	1.000	0	0.250
2	11	3	0.091	0	0.910	1.000	0.846	0.750	0.077	0
3	10	3	0	0	1.000	1.000	0.769	0.750	0	0
4	10	3	0	0	1.000	1.000	0.769	0.750	0	0
5	10	3	0	0	1.000	1.000	0.769	0.750	0	0
6	10	3	0	0	1.000	1.000	0.769	0.750	0	0
7	10	3	0.200	0.333	0.800	0.667	0.769	0.500	0.154	0.250
8	8	2	0	0	1.000	1.000	0.615	0.500	0	0
9	8	2	0	0	1.000	1.000	0.615	0.500	0	0.250
10	8	2	0	0.500	1.000	0.500	0.615	0.250	0	0
11	8	1	0	0	1.000	1.000	0.615	0.250	0	0
12	8	1	0	0	1.000	1.000	0.615	0.250	0	0

M = Male; F = Female.

respective months after birth.

**Troop B:** A total of 12 births (two females and 10 males) were recorded in troop B. Only eight of them reached the age of 12 months (Table 1). One infant disappeared at 0.5 month of age and three were killed by a new resident male when the ages of infants were between 1-2, 2-3 and 3-4 months.

**Troop KI:** A total of 12 births (seven females and five males) were recorded in troop KI. Five of the infants died; a male and female between 0-1 month, a female between 3-4 months, a male between 7-8 months, and a female between 8-9 months (Table 2). Infanticide was the cause of death for one infant; two infants died while crossing a high voltage power line; and the exact cause was not known for two infants.

**Troop KII:** A total of 17 births (four females and 13 males) were recorded in troop B, of which only nine infants reached the age of 12 months. Infanticide was the cause of death in seven cases; four died before the age of the three months; and three at the age of eight months. Also, one infant died while crossing a high voltage power line at the age of 11 months (Table 3).

Adult male replacement followed by infanticide has been observed in several species of predominantly one-male troop-living non-human primates (see Hausfater and Hrdy 1984) and some social carnivores such as lions (Bertram 1975, Packer and Pusey 1983). Hrdy (1974) based on her study of Hanuman langurs at Mount Abu suggested that males kill unrelated infants in order to induce sexual recep-

tivity in females, so that the killer males could then mate with the females to sire their own offspring. On the other hand, Rudran (1979a, b, in press) based on his study of red howler monkeys suggested that infanticide has evolved as a result of competition for food and this behavior enhances the fitness of infanticidal males and also their offspring. However, in this study, infanticide by adult males was observed to cause severe infant mortality since 11 out of 41 langur infants born in three troops were killed by invading males. The infanticidal males did not show any sexual discrimination and were seen to kill five female infants and six male infants (see Agoramoorthy and Mohnot 1988 for details). Although some older infants (eight months old in three cases) were killed by adult male invaders, younger infants were main targets because 72.7% of cases the infants were less than five months old. It appears that younger Hanuman langur infants were extremely vulnerable for infanticidal attacks. According to Rudran (in press), the victims of infanticide can be young as well as older infants. Furthermore, killing of older infants in three cases here indicated that vulnerability rather than age is the key determinant of death, as reported previously for the red howler monkeys (Agoramoorthy 1992, Rudran in press).

November 26, 1993      G. AGORAMOORTHY  
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### 3. RUSTYSPOTTED CAT (*FELIS RUBIGINOSA* GEOFFROY) SIGHTED NEAR UDAIPUR

Udaipur has a lake called Fateh Sagar with a road around it called Rani Road. The city is surrounded by hills and two of the big hills called Neemach Mata and Thoria Magra are under the forest department.

On 26th July 1992 at about 6.30 p.m. while driving on Rani Road, my daughter drew my attention to a dead cat lying near the road. I parked my vehicle and examined the animal. It was a small cat, probably killed in a road accident. The body was swollen apparently the cat had been killed about 20 hrs earlier. Its coat was grey with a light reddish tinge, with four dark brown stripes running from the forehead to a little beyond the shoulder dorsally.

The flanks and other parts of the body had rusty spots. On the hind quarter the size of the rusty spots was smaller than that on the forelimbs. The tail had no spots or marking. The chin and the underside of the forearms had dark brown stripes. The underside was white with black spots. I consulted "THE BOOK OF INDIAN ANIMALS" by S.H. Prater 1990 and found it to be a rusty spotted cat.

To the best of my knowledge this is the first sighting of a rusty spotted cat from Rajasthan.

July 2, 1993 RAZA TEHSIN  
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### 4. OCCURRENCE OF THE LEAF-NOSED BAT *HIPPOSIDEROS LANKADIVA* KELAART (MAMMALIA: CHIROPTERA: RHINOLOPHIDAE) IN RATNAGIRI DISTRICT, MAHARASHTRA

While working on the breeding biology of the Horseshoe bat, *Rhinolophus rouxi* Temminck, a bat collection trip was organised at Sangameshwar (17° 10' N, 73° 30' E) in Ratnagiri district of Maharashtra state in June 1990. Sangameshwar is a town on the Shastri river about 20 miles from the coast. Bats were collected using mist nets which were set on the river bank. In all 220 bats were captured in two mist net operations of which, 80 males and 110 females were identified as *R. rouxi* and 8 males and 22 females were identified as Leaf-nosed bat, *Hipposideros lankadiva*. Of the total collection, four pregnant females of each species were collected for laboratory studies and the rest were released. On

further survey by Kothari, a colony of about 200 bats of *H. lankadiva* was sited in the old Shiva temple which is situated on the western bank of the river Shastri. The identifications were confirmed by Muni using the BNHS collections.

According to authoritative literature *H. lankadiva* is known from Garo Hills, Assam (Kemp 1924); Gersoppa, Kanara (Ellerman and Morrison-Scott 1951, Wroughton 1913, Brosset 1962); Kolar, Eastern Mysore (Ellerman and Morrison-Scott 1951, Ryley 1913); Mundra, Sagor, Central Provinces (Ellerman and Morrison-Scott 1951, Wroughton and Ryley 1913a; BNHS collection); Talewadi, Belgaum (BNHS collections); Sohagpur, Hoshangabad, Bihar (Brosset 1962);